

Quantum Optics Effects in Astrophysics

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Investigation of the cosmic microwave background formation processes is one of the most actual problem at present time. We analyzed the response of the hydrogen atom to the external photon fields. Field characteristics are defined via conditions corresponding to the recombination era of universe. Approximation of three-level atom is used to describe the "atom - fields" interaction. It is found that the phenomena of the electromagnetically induced transparency (EIT) take place in this case. Additional terms to the optical depth entering in the Sobolev escape probability are found to contribute on the level about 1% in resonance [1].

We have evaluated the Bloch-Siegert shift for the different values of magnetic field's strengths defined at astrophysical conditions, i.e. when the stars with the strong surface magnetic fields are taken as a powerful pumping source of radiation. It is found that the additional shift of resonant frequency should be taken into account in the search for the time variation of the fundamental constants. The main conclusion is that the influence of the electromagnetic field shift should be considered carefully in each special case of the corresponding frequency determination [2].

[1] D. Solovyev, V. Dubrovich and G. Plunien, *J. Phys. B: At. Mol. Opt. Phys.* **45**, 215001 (2012)

[2] D. Solovyev, arXiv:1302.4598v1 [physics.atom-ph], 19 Feb 2013